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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Katsuhisa Sawazaki

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MCGINN & GIBB

PLLC

8321 OLD COURTHOUSE ROAD

SUITE 200

VIENNA, VA 22182-3817

EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 02/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/522,832

Applicant(s)

SAWAZAKI ET AL.

Examiner

B. William Baumeister

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AW

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 February 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 4-31 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1 and 4-31 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____ | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 18, 19, 26, 27, 28 and 29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

a. Claim 18 recites that the n-type clad layer, the cap layer and each of the barrier layers are formed of substantially the same material and under substantially the same conditions, thereby providing a substantially same strain on said MQW structure. This limitation includes new matter because the specification, as filed, did not set forth that these respective layers provide a substantially same strain on the MQW structure.

3. Claims 18, 19, 26, 27, 28 and 29 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In heterojunctions formed between materials of dissimilar lattice constant, the strain exerted on a first layer is a function of, *inter alia*, the thickness of the second layer. Thus, because the n-clad,

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barriers, and cap layer are disclosed as having different thicknesses, the skilled artisan would not be reasonably apprised of how to form these different-thickness layers of the same material such that they produce the same strain on the wells.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1, 4-31 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "substantially" in the limitation "by having been formed under substantially same conditions" in the independent claims is a relative term which renders the claim indefinite. The term "substantially" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

a. The specification states, "[t]hen a barrier layer 162 of GaN about 70A thick was formed in the same condition as used for forming the n-type clad layer 15." (page 9, lines 3-5.) The specification's use of the language, "same condition" instead of the claim's alternative language, "substantially the same condition," indicates that the claim language is broader than the specification language, raising the question of what differences in conditions would constitute being deemed "*substantially* the same."

Claim Rejections - 35 USC § 102 / § 103

6. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Insofar as definite, claims 1, 4, 7-17, 20-25 and 31 are rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Nakamura et al. '350.

a. Nakamura teaches GaN-based LEDs and LDs comprising (using the reference numerals of FIG 1, but also see the other embodiments including the ninth embodiment depicted in Fig 16 and discussed at cols. 27-28) a MQW active layer 14; an n clad 13 which is in contact with the light emitting layer; a first p-type clad/cap 61; a second p-type clad 62 having a larger Al content (or bandgap) than the first clad and formed directly thereon. Any layer on which the n-clad is formed may be deemed to be an "intermediate layer" per claims 4 and 31. See e.g., GaN layer 12 which is devoid of aluminum.

b. The first n-clad may be composed of either GaN or InGaN and have a thickness as small as 10 to 30 angstroms (e.g., col. 5, line 7; col. 7, line 10-20; col. 19, lines 62- and claim 8). Various examples employ the specific thickness of 500 angstroms (e.g., Example 11, col. 39). The MQW active layer has InGaN wells, and the barriers may be composed of either GaN or InGaN (e.g., col. 7, lines 45-50; col. 15, lines 25-30; col. 20, lines 38-30; and claim 11 as amended by the Certificate of Correction). As the first n-clad and the barriers may both be composed of GaN (see e.g., the 5th – 7th embodiments

wherein they are, in fact, both composed of GaN), they are of substantially the same material and have substantially the same bandgap, as set forth in claims 1 and 15.

c. The wells of the MQW active layer are less than 70 Å and preferably less than 50 Å, (or “approximately 30 Å”), and the barriers’ thicknesses are set to 150 Å or less, (or “approximately 70 Å”) per claim 8 (e.g., col. 7, lines 55-67).

d. The first p-clad 61 functions to prevent decomposition of the active layer's InGa_N quantum wells (col. 8, lines 20-25). As such it functions as “a cap layer.” Nakamura further states that it is preferable that this clad/cap be composed of AlGa_N--as opposed to Ga_N (the latter being substantially the same material as the MQW barrier). However, Nakamura explains that the reason for including Al is that AlGa_N was easier to p-dope than was Ga_N, and states that the alternative use of Ga_N as the clad/cap reduces the emission by 1/3 (col. 8, lines 28-35), indicating that such devices having a Ga_N clad/cap were actually constructed. Restated, the fact Nakamura ‘350 teaches that AlGa_N is preferable to Ga_N does not teach away from using Ga_N for the cap/clad. Rather, the reference teaches that using Ga_N was known, but that AlGa_N was better. See MPEP 2131.05 which states that “a reference is no less anticipatory if, after disclosing the invention, the reference then disparages it. The question whether a reference ‘teaches away’ from the invention is inapplicable to an anticipation analysis.” [internal cites omitted]

e. The newly added claim language, “by having been formed under substantially same conditions,” constitutes a product-by-process limitation. The following case law makes clear that in claims directed towards a product, it is the patentability of the final

product per se which must be determined, no matter how actually made. Further, an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or otherwise. *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also, *In re Brown*, 173 USPQ 685; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161; *In re Wethheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); *In re Marosi et al.*, 218 USPQ 289; and particularly *In re Thorpe*, 227 USPQ 964. Note that in such cases, the burden is on applicant to prove that claim language relating to the method of making the device results in a structural difference over the prior art.

f. Regarding claim 9, 14, 20 and 25, the (second) p-clad has an Al concentration that may be set within the range of 0 to 0.4 inclusive for the purpose of increasing light emission intensity (or "optimizing color intensity") (e.g., col. 20, lines 13-37).

g. Regarding claims 10-13 and 21-24, Nakamura discloses that the active layer may be composed of a MQW structure that emits light having a wavelength ranging from about 365 nm to 660 nm (i.e., UV to red), which is inclusive of the green and blue wavelengths set forth in the claims. The thickness of the (second) p-clad may be set within the range of 50 Å to 1 µm. (e.g., col. 20, line 32).

h. It is unclear whether the scope of the limitation "having been formed under substantially same conditions" in the independent claims precludes reading on Example 13 discussed in the previous Advisory Action wherein the n-tunnel/clad 125 is composed of 500-Ångstrom thick $\text{In}_{0.01}\text{Ga}_{0.99}\text{N}$ (from example 8), and the barrier of the MQW active region (Example 13) is composed of 20-Ångstrom thick $\text{In}_{0.02}\text{Ga}_{0.98}\text{N}$. Under the

theory that inclusion of the word “substantially” broadens the claim to include this possibility, various ones of the claims are anticipated at least by this embodiment.

- i. Alternatively, assuming that the limitation must be read narrowly, so as to preclude this minute difference in composition, the Examiner has previously explained in the advisory action that other portions of Nakamura ‘350 disclose both of these layers being composed of GaN, and the 102/103 rationales set forth previously for those portions of the disclosure are incorporated herein.
- i. Assuming *arguendo* that none of the embodiments disclosed in Nakamura ‘350 individually in isolation set forth all of the limitations claimed with sufficient specificity to constitute an anticipation rejection, the claims are alternatively rejected as being obvious over the disclosure read as a whole for the reasons set forth in the previous advisory action dated 11/22/2003 and the final office action dated July 26, 2003.

8. Insofar as definite, claims 1, 4-6, 15-17, 20-25 and 30 are rejected under 35 U.S.C. 102(e) as being anticipated by Nakamura et al. ‘307. Note for example FIGs 3-5 wherein a MQW active region 16 is adjacent to n-type region 201 which is formed of a material having a larger band-gap than that of the active region (clad region) and having a thickness of < 500 angstroms. The barrier layers or the active region are disclosed as having a thickness of about 50 angstroms (col. 14, lines 42-51). Also, an intermediate layer 402 is adjacent to the clad region 401 and is recited as being able to be composed of $\text{In}_k\text{Ga}_{1-k}\text{N}$ ($0 \leq k \leq 1$), or “devoid of Al” (col. 10, lines 45-50). The previous Office actions set forth the Examiner’s position for why Nakamura ‘307 discloses that the n- and p-tunnel clads and barriers may both be composed of GaN. Also, claim 20 does

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not require that the p-clad be directly on or contacting the cap; thus in FIG 5, layer 101 reads on the p-cap and layer 103 reads on the p-clad. Whether the layers have been formed under the same condition does not distinguish the final structure according to the product-by-process doctrine.

Response to Arguments

9. Applicant's arguments filed 2/17/2004 have been fully considered but they are either moot in light of the new grounds of rejection or are not persuasive. Most of the arguments have been addressed either hereinabove and previously, including within the advisory action dated 11/22/2003. Some of the points are addressed again as follows:

a. Applicant argues that because Nakamura '307 discloses that the use of AlGaN for the tunnel/clad is preferable to GaN, the reference teaches away. As was explained, Nakamura '307 also discloses that, notwithstanding that AlGaN may be preferable, the layer may also be composed of GaN. See MPEP 2131.05 which states that "a reference is no less anticipatory if, after disclosing the invention, the reference then disparages it. The question whether a reference 'teaches away' from the invention is inapplicable to an anticipation analysis." [internal cites omitted]

b. Applicant asserts that the disclosure in each of the two Nakamura references—that the barriers and n-clad may be composed of the same composition—at most, leaves open the possibility that the disclosed structure may be modified in this manner, but does not constitute an anticipation of the elements. The examiner disagrees. The references each disclose each of the layers as claimed and also discloses that the pertinent layers may be composed of the same material. As such, the references disclose every limitation

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and the claims are anticipated. Therefore, secondary considerations associated with obviousness rejections, such as “teaching away,” are not applicable.

c. Applicant further argues that relative to claims 9 and 17, Nakamura '350 does teach against using GaN as the first p-clad layer 61. The Examiner would have the initial burden of overcoming this express preference in Nakamura.

i. As was explained previously, Nakamura '350 provides various embodiments wherein both the MQW barriers and the tunnel/clad are composed of GaN. (See e.g., the fifth through the seventh embodiments.) The features of the active layer of the 7th embodiment may be the same as those explained in the 1st, 5th and 6th embodiments (col. 20, lines 38-39). The thicknesses of the well and barrier layers of the 5th and 6th embodiment may be the same as that explained with reference to the first embodiment (col. 16, lines 1-4). The first embodiment, in turn, states that the active layer may be composed of a SQW or a MQW structure (e.g., col. 6, lines 20-; col. 7, lines 33-). The wells and barriers may be composed of (In)GaN (e.g., col. 7, and col. 15, lines 25-30).

ii. Again, MPEP 2131.05 states that “a reference is no less anticipatory if, after disclosing the invention, the reference then disparages it. The question whether a reference ‘teaches away’ from the invention is inapplicable to an anticipation analysis.” [internal cites omitted]

iii. As such, the question of whether these claims are anticipated does not rest on whether the reference teaches both may be composed of GaN. Rather the issue devolves to whether, in those portions that do teach composing both of GaN, the

reference teaches that the clad should be thicker than the barrier. Nakamura '350 does not expressly recite that when GaN barriers and clads are employed, the clad thickness will necessarily be greater. Rather, the alternative case is theoretically possible because Nakamura '350 recites overlapping ranges: e.g., the tunnel/clad may range from 10 Å to 1.0 µm and more preferably from 30 Å to 0.1 µm (col. 7, lines 15-20) and the barriers of the MQWs should be 150 Å or less (col. 7, lines 65-67). However, every single example which employs a MQW active region provides barriers that are orders of magnitude thinner than the tunnel/clad. For example, Example 4: clad = 100 nm and barrier = 50 Å; Example 13: clad = 500 Å and barrier = 20 Å; Example 24: clad = 500 Å and B = 10 Å; Example 25: clad = 500 Å and barrier = 50 Å; and Example 26: clad = 500 Å and barrier = 50 Å. Thus, when all of the parts of Nakamura '350 are read as a whole, as urged by Applicant, one skilled in the art would understand--notwithstanding the theoretical potential for range overlap--that Nakamura teaches this thickness relationship with sufficient specificity to support an anticipation rejection of those claims that further set that the barrier is composed of GaN.

d. Even if various claims are interpreted under the range-doctrine so as to not be anticipated by either Nakamura '350 or Nakamura '307, the Examiner has set forth sufficient rationales why these various limitations would have been at least obvious. Having made a *prima facie* showing of obviousness, the burden has shifted back to Applicant to rebut the showing. However, because Nakamura '350 does, in fact, teach that the clad and barrier may be composed of the same material, including GaN, and does

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appreciate that the subjacent n-clad composition and the superjacent p-clad composition influence the strains in--and color purity of--the active layer as well as the level of light emission, Applicant's arguments--that the color-purity and light-emission optimization issues were unknown or nonobvious considerations--are not persuasive. As such, the rejections are still deemed to be proper.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to B. William Baumeister whose telephone number is (571) 272-1722. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

B. William Baumeister
Primary Examiner
Art Unit 2815

**BRADLEY BAUMEISTER
PRIMARY EXAMINER**

